

THE ALPINE VEGETATION OF THE LESOTHO DRakensBERG: A STUDY IN QUANTITATIVE FLORISTICS AT OXBOW

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ABSTRACT

A quantitative survey of the botanical composition and basal cover of portion of the Madibamatso (Oxbow) Dam catchment at 2 800 m in the Lesotho Drakensberg, indicates that the vegetation has an average basal cover of 29%, is temperate in character and comprises 126 species. *Gramineae* (18 spp.) make up 65% of the basal cover and *Helichrysum* (12 spp.) makes up 8%. Of the total cover, 70.2% is comprised of only 10 species. Dominant grasses are *Danthonia*, *Harpechloa*, *Festuca*, *Poa*, *Themeda* and *Eragrostis* in that order. Of the macchia, *Erica* (5 spp.) is the most abundant. Tall sclerophyllous genera such as *Cliffortia* and *Anthospermum* are absent. *Chrysocoma tenuifolia* and *Pentzia cooperi* dominate overgrazed sites. Of the families present *Compositae* (36 spp.), *Gramineae* (23 spp.) and *Scrophulariaceae* (10 spp.) are the best represented.

UITTREKSEL

DIE ALPYNSE PLANTEGROEI VAN DIE LESOTHO DRakensBERG: 'N KWANTITATIEWE FLORISTIESE STUDIE TE OXBOW

'n Kwantitatiewe opname van die botaniese komposisie en basale bedekking van 66 vk. km van die opvanggebied van die beplande Madibamatso (Oxbow) dam teen 2 800 m in die Lesotho Drakensberg is onderneem. Resultate toon dat die basale bedekking gemiddeld 29% is, dat die plantegroei gemagtig in karakter is en dat dit 126 spesies insluit. *Gramineae* (18 spp.) maak 65% van die bedekking uit en *Helichrysum* (12 spp.) maak 8% uit. Van die totale bedekking is slegs 10 soorte verantwoordelik vir 70.2% van die bedekking. Dominante grasse is *Danthonia*, *Harpechloa*, *Festuca*, *Poa*, *Themeda* en *Eragrostis* in daardie volgorde. Van die fynbossoorte is *Erica* (5 spp.) die mees volop. Hoë fynbostipes soos *Cliffortia* en *Anthospermum* is afwesig. *Chrysocoma tenuifolia* en *Pentzia cooperi* is volop naby veeposte. Van die families teenwoordig, het *Compositae* 36 spp., *Gramineae* 23 spp. en *Scrophulariaceae* 10 spp.

INTRODUCTION

The vegetation of the eastern section of the Drakensberg has been described in varying depths by a number of botanists (Thode, 1894; Galpin, 1909; Bews, 1917; Markotter, 1930; Staples and Hudson, 1938; Schelpe, 1946; West, 1951; Acocks, 1953; Van Zinderen Bakker, 1955; Killick, 1963; Edwards, 1963; and Jacot-Guillarmod, 1963). Unfortunately many of these authors either only described certain communities, often in terms of dominants only, or limited their investigations to generalized sketches of the flora. The most detailed descriptions

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are those of Schelpe (1946), Killick (1963) and Edwards (1963). In the Maluti section of the Drakensberg, the comprehensive description of the Leribe Plateau as published by Phillips (1917) on the basis of Madame Dieterlen's collections is a particularly useful contribution to present knowledge of the mountain flora.

STUDY AREA AND PROCEDURE

The present study was undertaken in the Tshlanyane valley of the Madibamatso catchment above the proposed Oxbow Dam site in the extreme northern corner of Lesotho during the summer of 1969/70. The study area comprises 66 sq. km. of steep treeless alpine grassland situated between 2 590 m and 3 050 m (see Fig. 1). The soil is derived from Drakensberg basalt, the rainfall averages 1 272 mm and absolute maximum and minimum temperatures are 22°C and 2°C

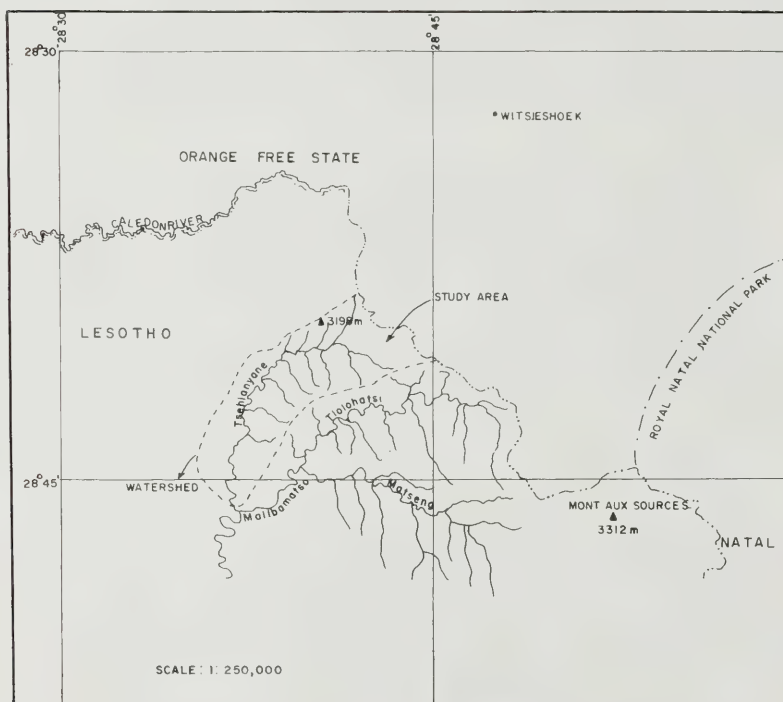


FIG. 1.
Geographic situation of the Tshlanyane Catchment.



FIG. 2.
Portion of the Tsehlanyane Valley.

in summer, with winter equivalents of 13°C and -13°C . The area is regularly snow-clad during winter and snow may persist for several months particularly on southern slopes. (Fig. 2.)

The quantitative survey was based on 102 sampling sites each 35 m^2 in size. The position of these sites was determined by superimposing a grid on enlarged aerial photographs (1:15 000) of the Tsehlanyane valley. Survey data is based on a sample of 500 points taken with a single aluminium wheel, using a reading spoke of 3 mm diameter, with points every 1.5 m. Strikes on living plants at soil level were recorded as defined by Tidmarsh and Havenga (1953). Nearest plant data were recorded in the absence of a strike. Plots were permanently marked as described by Herbst (1971). Details of techniques applied and results obtained in investigations into the quantitative relationships between habitat factors (soil properties, slope, altitude and aspect) and vegetation attributes (botanical composition and basal cover) have been reported elsewhere (Herbst and Roberts, 1974).

Following Phillips' (1959) proposal for the calculation of an "Importance Value" for each species, results have been based on the number of strikes plus the number of times each species was recorded as nearest plant, giving the percentage contribution of each species to botanical composition.

RESULTS

The plant collection from the survey area as a whole comprized 126 species of higher plants, of which 80 were recorded within the sampling sites. All specimens were identified by the National Herbarium, Pretoria and duplicate specimens are lodged in the Department of Pasture Science, University of the Orange Free State, Bloemfontein.

The flora is a simple one in terms of number of species and formations, compared with the nearby vegetation at Golden Gate (460 spp.) and Thaba

TABLE 1.

Contribution of species to the vegetation of the Tsehlanyane Valley, based on basal cover and nearest plant records (56 000 points, 102 sites).

Plant species	% Contribution (Basal cover & Nearest Plant)
<i>GRAMINEAE</i>	
<i>Danthonia disticha</i>	22,6
<i>Harpechloa falx</i>	7,4
<i>Festuca caprina</i>	6,3
<i>Poa annua</i>	4,6
<i>Themeda triandra</i>	4,2
<i>Eragrostis caesia</i>	3,9
<i>Pentaschistis galpinii</i> }	5,5
<i>P. jugorum</i> }	
<i>P. setifolia</i> }	
<i>Aristida junciformis</i>	2,9
<i>Danthonia drakensbergensis</i>	2,6
<i>Koeleria cristata</i>	1,5
<i>Helictotrichon turgidulum</i>	0,6
<i>Agrostis barbuligera</i>	0,5
<i>Anthoxanthum dregeanum</i>	—
<i>Bromus speciosus</i>	0,5
<i>Festuca</i> spp. }	
<i>Pennisetum thunbergii</i> }	
<i>Agrostis lachnantha</i> }	
TOTAL FOR GRASSES	63,0
<i>HELICHRYSUMS</i>	
<i>Helichrysum flanaganii</i>	3,5
<i>H. subglomeratum</i>	2,3
<i>H. infaustum</i>	0,9
<i>H. marginatum</i>	0,9
<i>H. trilineatum</i>	0,5
<i>H. squamosum</i> }	0,3
<i>H. setosum</i> }	
<i>H. adenocarpum</i> }	
<i>H. kuntzei</i> }	
<i>H. odoratissimum</i> }	
<i>H. scapiforme</i> }	
<i>H. sessile</i> }	
TOTAL FOR HELICHRYSUMS	8,4

MACCHIA, SEGDES and HERBS

<i>Scirpus falsus</i>	10,8
<i>Oxalis depressa</i>	3,4
<i>Cyperus schlechteri</i>	1,7
<i>Scirpus ficinioides</i>	1,4
<i>Fimbristylis exilis</i>	0,9
<i>Kniphofia caulescens</i>	0,7
<i>Cenia microglossa</i>	0,6
<i>Senecio othonnaeflorus</i>	0,6
<i>Gazania</i> sp.	0,5
<i>Marulia flanaganii</i>	0,5
<i>Geum capense</i>	0,5
<i>Chryscoma tenuifolia</i>	0,5
<i>Anthospermum rigidum</i>	
<i>Athanasia thodei</i>	
<i>Crassula setulosum</i>	
<i>C. rubescens</i>	
<i>C. sarcocaulis</i>	
<i>C. cooperi</i>	
<i>Dianthus micropetalus</i>	
<i>D. basuticus</i>	
<i>Carex clavata</i>	
<i>Euryops montanus</i>	
<i>Erica dominans</i>	
<i>E. frigida</i>	
<i>E. algida</i>	
<i>E. sp. (No. 3526)</i>	
<i>Geranium incanum</i>	
<i>Berkheya</i> sp. (No. 5832)	
<i>Senecio achilleaeifolius</i>	4,2
<i>S. inaequidens</i>	
<i>S. concolor</i>	
<i>Mohria cafforum</i>	
<i>Pellae quadripinata</i>	
<i>Fimbristylis exilis</i>	
<i>Dierama</i> sp.	
<i>Psammotropha alternifolia</i>	
<i>Lotononis galpinii</i>	
<i>Pentzia cooperi</i>	
<i>Zaluzianskya alpestris</i>	
<i>Scabiosa columbaria</i>	
<i>Wahlenbergia caledonica</i>	
<i>Athrixia fontana</i>	
<i>Felicia pinnatifida</i>	
<i>Hebenstreitia dentata</i>	
<i>Eumorphia sericea</i>	2,2
"Unknown herbs"	
TOTAL FOR MACCHIA	28,6
	100,0

'Nchu (448 spp.) as reported by Roberts (1966 and 1969). Killick's (1963) collection in the Cathedral Peak area, covering an altitudinal difference of 1 500 m includes 907 species of which 305 are monocotyledons and 556 are dicotyledons.

The contributions of the 80 species recorded in the quadrats at Tsehlanyane are summarized in Table 1. With the exception of *Poa annua*, the relative im-

portance value of the more abundant species coincides with the order in which these species are ranked according to basal cover (see Herbst and Roberts, 1974).

It may be seen from Table 1 that the grasses (18 spp.) make up 65% of the vegetative cover of the study area, while *Helichrysum* (12 spp.) makes up 8%. It is also shown that 70.2% of the cover is made up of only 10 species.

No quantitative surveys in the alpine zone of the Drakensberg are available for comparison, but whereas this study exposes *Danthonia*, *Harpechloa*, *Festuca*, *Poa*, *Themeda* and *Eragrostis caesia* as the most important dominants, Killick's (1963) point surveys at Cathedral Peak (2 000 m) record *Themeda*, *Trachypogon*, *Tristachya*, *Harpechloa* and *Heteropogon* as the dominants. At Cathedral Peak *Helichrysums* only contributed 0.1% to basal cover, as compared with 8.4% at Tsehlanyane. It is significant to note that the same number of species of grasses (18) recorded in the point surveys are present in these two survey areas; although Killick states that *Themeda* "drops out at about 2 835 m" and "appears again, frequently in pure stands above 2 440 m on the Lesotho side of the escarpment".

Comparison of the lists of dominants at Cathedral Peak and Tsehlanyane clearly indicates an increasing temperate affinity not only of the grasses, but also of the herbs from 2 000 m to 2 750 m. Dominants of the macchia ("fynbos") vegetation as listed by Acocks (1953) for the temperate regions of the Cape which occur at Tsehlanyane, include *Erica*, *Pelargonium*, *Satyrium*, *Euryops*, *Helichrysum*, *Pentzia*, *Senecio*, *Passerina*, *Muraltia* and *Moraea*. Of the sclerophyllous bush types present at Tsehlanyane, the genus *Erica* is the most abundant, with *E. dominans*, *E. frigida* and *E. algida* important. Other sclerophyllous bush types are *Passerina*, *Euryops* and *Athanasia*. The taller types such as *Cliffortia* and *Anthospermum* which are common in macchia formations at mid-altitudes (Roberts, 1961, 1963, 1966a) are absent from the Tsehlanyane vegetation, but *Chrysocoma tenuifolia* and *Pentzia cooperi* are present in localized overgrazed sites near cattle posts.

TABLE 2.
Predominant families at Tsehlanyane, Cathedral Peak(1) and Leribe Plateau(2).

	No. species at each site		
	Tsehlanyane	Cathedral Peak	Leribe Plateau
Compositae	36	154	286
Gramineae	23	100	146
Scrophulariaceae	10	46	86
Crassulaceae	8	14	35
Cyperaceae	6	46	75
Ericaceae	5	20	20
Liliaceae	2	47	101
Iridaceae	2	32	36
Orchidaceae	2	44	89
Leguminosae	2	27	95

(1. Killick, 1963; 2. Phillips, 1917).

Both the simplicity of the vegetation and the predominant families at Tsehlanyane, relative to Cathedral Peak and Leribe Plateau are indicated in Table 2.

Whereas *Compositae* and *Gramineae* are the best represented families at all the above areas, *Liliaceae* and *Orchidaceae* appear to lose significance with altitude, while *Scrophulariaceae* are important at all three localities. Within the *Gramineae* it is noteworthy that whereas Killick (1963) reports the prominent grasses between 2 600 m and 2 750 m to include *Trachypogon* and *Tristachya*, neither of these was recorded at a similar altitude and on a similar soil at Tsehlanyane. Acocks' (1953) description of this "*Themeda*—*Festuca* Alpine Veld" (Type 58) has been criticized by Killick (1963) who maintains that the temperate species become dominant "to the complete exclusion of *Themeda*" in the summit vegetation. The present quantitative study demonstrates that *Themeda* is more abundant than thirteen other grass species, most of which are temperate.

It is noteworthy that many of the families which occur at the altitude of the study area, are represented by only one or two species. Of the 28 families present, 13 have only two species and 7 have only one species present (see Table 3).

TABLE 3.
Number of species in each of the 28 families present
at Tsehlanyane, Lesotho.

Compositae	36
Gramineae	23
Scrophulariaceae	10
Crassulaceae	8
Cyperaceae	6
Ericaceae	5
Caryophyllaceae	3
Gentianaceae	3
Adiantaceae	2
Juncaceae	2
Liliaceae	2
Iridaceae	2
Orchidaceae	2
Rosaceae	2
Leguminosae	2
Geraniaceae	2
Polygalaceae	2
Thymelaeaceae	2
Umbelliferae	2
Boraginaceae	2
Campanulaceae	2
Schizaeaceae	1
Eriocaulaceae	1
Velloziaceae	1
Phytolaccaceae	1
Oxalidaceae	1
Asclepiadaceae	1
Dipsacaceae	1



FIG. 3.
Moteng Pass area. X marks the treeline at 2 600 m.



FIG. 4.
Stunted *Buddleia* clump at 2 830 m.

The most striking feature of the vegetation in the study area is the almost complete lack of trees, shrubs and woody plants generally. The decrease in tree growth with increased altitude is a well-known phenomenon which has been recorded by many writers. The tree-line on the Natal escarpment of the Drakensberg is at approximately 1 830 m, while on the Lesotho side, in the Moteng Valley, it is at 2 600 m (see Fig. 3). The only rudiments of forest in the Tsehlanyane area are a few very stunted specimens of *Leucosidea sericea* and *Buddleia corrugata* growing in very rocky situations at 2 830 m. Tree-ring studies on these specimens indicated that their stems had grown to a diameter of 1.5 cm in 5 years in the case of *Buddleia* and in 19 years in the case of *Leucosidea*. In no case were these species taller than 1.3 m at this altitude (see Fig. 4).

This type of morphological adaptation is generally attributed to the effect of altitude on the ultra-violet fraction of sunlight, which reduces cell elongation through its inactivating influence on growth hormones. There is evidence that the local distribution of these species is limited to rocky situations because of the protection which such habitats afford against fire. It may further be assumed that the slow growth rate is due to low temperatures and not to moisture deficiency *per se*, although physiological drought must operate under the temperature



FIG. 5.
Danthonia, *Erica* and *Helichrysum* at 3 000 m

conditions prevailing. Thus also the xeromorphic structure of many of the dominant species such as *Danthonia*, *Helichrysum* and *Erica* at the highest altitudes (see Fig. 5).

As far as the dense cushion-form habit of certain of the grasses is concerned, the influence of a century's continuous summer grazing by domestic stock must be taken into account. Thus while highly palatable species such as *Harpechloa* and *Themeda* are dense mat-forming types at Tsehlanyane, less palatable species such as *Danthonia* and *Festuca* are generally more upright and tufted in form.

The communities of specific habitats at Tsehlanyane will be dealt with in a separate report.

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